

CLAIMS

What is claimed is:

1. A switch matrix assembly for use in a keypad, said switch matrix comprising:
 - 5 a support frame;
 - at least one cross member; and
 - a plurality of coupling means for releasably attaching a cross member to the support frame whereby each of the at least one cross member may be releasably attached to the support

10 frame in selectable positions to thereby form a variety of different button patterns, each button pattern comprising at least one button position.
2. The switch matrix assembly of claim 1 wherein the support frame is substantially rectangular in shape having a top support, a bottom support, and a left and a right support.
3. The switch matrix assembly of claim 2 wherein the plurality of coupling means are disposed on the left and the right supports such that each of the at least one cross member extends in a substantially horizontal direction when releasably attached to the support frame.

4. The switch matrix assembly of claim 3 further comprising a light baffle, said light baffle extending in a substantially vertical direction.

5 5. The switch matrix assembly of claim 3, wherein the top support, bottom support, and each of the at least one cross member comprise at least one cantilever protruding therefrom.

10 6. The switch matrix assembly of claim 5, wherein each of the at least one button position comprises a first cantilever and a second cantilever disposed on opposing sides of the button position, both the first cantilever and second cantilever comprising a free end and an attached end.

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7. The switch matrix assembly of claim 6 wherein both the first cantilever and the second cantilever are substantially parallel to each other.

20 8. The switch matrix assembly of claim 6 wherein each of the at least one cantilever is substantially parallel to the top support, the bottom support, or each of the at least one cross member from which it protrudes, whichever it may be.

9. The switch matrix assembly of claim 6 wherein each of the at least one cantilever further comprises an upwardly extending protrusion disposed on its free end, said upwardly extending protrusion capable of engaging a bottom surface of 5 a button or key.

10. The switch matrix assembly of claim 9 wherein the upwardly extending protrusion does not fixidly engage the bottom surface of a button or key.

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11. The switch matrix assembly of claim 6 wherein the first and second cantilever of each of the at least one button position provide an upwardly directed restoring force to return a depressed button or key to a normal position.

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12. The switch matrix assembly of claim 11 wherein the first and second cantilever of each of the at least one button position provide an upwardly directed restoring force to maintain a button or key in the normal position.

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13. The switch matrix assembly of claim 1 wherein each of the at least one button position further comprises a light shroud for channeling light from a light source to a specified region of a button or key.

14. The switch matrix assembly of claim 13 wherein the support frame comprises a plurality of integrated light shrouds.

5 15. The switch matrix assembly of claim 14 further comprising a baffle, said baffle comprising a plurality of appended light shrouds.

16. The switch matrix assembly of claim 15 wherein each 10 of the at least one button position further comprises a panel for impeding light from a light source from bleeding into adjacent button positions, said panel being part of said baffle.

15 17. The switch matrix assembly of claim 1 wherein each of the at least one button position further comprises an engagement means for releasably attaching a button or key.

18. The switch matrix assembly of claim 17 wherein each 20 of the at least one button position may releasably engage a button assembly.

19. The switch matrix assembly of claim 18 wherein the button assembly comprises a base and a lens, a label being optionally disposed between said base and said lens.

5 20. The switch matrix assembly of claim 19 wherein the base further comprises a bottom surface having a plurality of legs extending therefrom, each of said plurality of legs comprising an engagement member, the engagement member interacting with the engagement means to thereby releasably
10 attach the button assembly.

21. The switch matrix assembly of claim 20 wherein the interaction between the engagement member and the engagement means is a snap fit.

22. A switch matrix assembly configurable to form a plurality of distinct button patterns, each button pattern comprising one or more button positions, said switch matrix comprising:

5 two or more cross members;

a frame means for supporting the two or more cross members;

a plurality of coupling means for releasably attaching each of the two or more cross members to the frame means; and

10 whereby the two or more cross members may be selectively positioned on the frame means to provide the plurality of distinct button patterns.

23. The switch matrix assembly of claim 22 further comprising a barrier means for baffling light, said barrier means impeding the bleeding of light from a light source illuminating a specific button position to other button positions, if present.

20 24. The switch matrix assembly of claim 23 wherein each of the one or more button positions comprises a shroud means for channeling light to a specified region on a button or a key when said button or key is installed in said button position.

25. The switch matrix assembly of claim 24 wherein the shroud means may be integrated into the frame means or appended to the barrier means.

5 26. The switch matrix assembly of claim 24 wherein the shroud means further comprises a light channel.

27. The switch matrix assembly of claim 22 wherein each button position comprises a resilient means for providing a 10 restoring force to return the button or key to a normal position after said button or key is depressed.

28. The switch matrix assembly of claim 27 wherein the resilient means comprises a first cantilever and a second 15 cantilever, said first cantilever and second cantilever having a free end and an attached end.

29. The switch matrix assembly of claim 28 wherein each of the one or more button positions further comprises a first 20 set and a second set of opposing sides, said attached end of the first and second cantilevers being attached to opposing sides of the first set or the second set.

30. The switch matrix assembly of claim 29 wherein the first cantilever and second cantilever further comprise an upwardly extending protrusion limiting travel, said upwardly extending protrusion capable of engaging a bottom surface of 5 a button or key.

31. The switch matrix assembly of claim 29 wherein the first cantilever and the second cantilever are substantially parallel to the sides to which they are attached.

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32. The switch matrix assembly of claim 31 wherein each of the sides comprises a midpoint, said free ends of the first and second cantilevers being located at approximately the midpoint of the sides to which their respective cantilevers 15 are attached.

33. The switch matrix assembly of claim 32 wherein a button or key installed in one of the one or more button positions is not fixidly engaged to the first and second 20 cantilevers.

34. The switch matrix assembly of claim 22 wherein each of the one or more button positions further comprises an engagement means for releasably attaching a button or key.

35. The switch matrix assembly of claim 22 wherein each of the one or more button positions further comprises an engagement means for releasably attaching a button assembly.

5 36. The switch matrix assembly of claim 35 wherein the engagement means may comprise one or more wings disposed on one or more of the two or more cross members.

10 37. The switch matrix assembly of claim 36 wherein the engagement means may further comprise one or more engaging slots disposed on the frame means.

15 38. The switch matrix assembly of claim 35 wherein the button assembly comprises a base and a lens, a label being optionally disposed between said base and said lens.

20 39. The switch matrix assembly of claim 35 wherein the base further comprises a bottom surface having a plurality of legs extending therefrom, each of said plurality of legs comprising an engagement member, the engagement member interacting with the engagement means to thereby releasably attach the button assembly.

40. The switch matrix assembly of claim 39 wherein the interaction between the engagement member and the engagement means is a snap fit.

41. A switch matrix assembly configurable to form a plurality of distinct button patterns, each button pattern comprising one or more button positions, said switch matrix assembly comprising:

5 a support frame, said support frame comprising a first support, a second support, a third support and a fourth support;

a plurality of cantilevers being disposed on the first and second supports;

10 a plurality of receiving channels being disposed on the third support;

a plurality of cutouts being disposed on the fourth support;

two or more cross members, each of the two or more cross
15 members comprising a plurality of cantilevers and a first and second ends;

a guide post being disposed on the first end of each of the two or more cross members;

20 a protruding ledge being disposed on the second end of each of the two or more cross members; and

whereby each of the two or more cross members may be releasably attached to the third and fourth support to form the one or more button positions when the guide post is inserted into the cutout on the fourth support and the

protruding ledge is inserted into the receiving channel on the third support.

42. The switch matrix assembly of claim 41 wherein each of the one or more button positions comprises a first cantilever and a second cantilever.

43. The switch matrix assembly of claim 41 further comprising a baffle.

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44. The switch matrix assembly of claim 41 wherein each of the one or more button positions further comprises a light shroud.

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45. The switch matrix assembly of claim 41 wherein the support frame comprises a plurality of integrated light shrouds.

46. A button assembly for actuating an electrical switch, said button assembly comprising:

a lens, said lens being composed of a transparent material, said lens further comprising a bottom surface;

5 a base, said base comprising a top surface and a bottom surface, said top surface comprising a recessed portion adapted to receive the bottom surface of the lens; and

a first means for releasably coupling the lens and base together.

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47. The button assembly of claim 46 further comprising a second means for releasably attaching the button assembly to a structure.

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48. The button assembly of claim 47 wherein the recessed portion is further adapted to receive a label, said label being interposed between the bottom surface of the lens and the recessed portion of the top surface of the base when the lens and the base are coupled together.

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49. The button assembly of claim 48 wherein the base diffuses light from a first source passing through the base.

50. The button assembly of claim 48 wherein the base further comprises a hollow passage for allowing light from a second source to pass unimpeded through the base.

5 51. The button assembly of claim 50 wherein the lens and the base are composed of plastic.

52. The button assembly of claim 51 wherein the structure is a switch matrix.

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53. The button assembly of claim 46 further comprising a plurality of legs disposed on the bottom surface of the base, each of the plurality of legs comprising an engagement member for releasably attaching the button assembly to a 15 structure.

54. The button assembly of claim 53 further comprising a cross support extending between two of the plurality of legs, said cross support used to depress a plunger on the 20 electrical switch when the button assembly is in use.

55. The button assembly of claim 54 wherein the recessed portion is further adapted to receive a label, said label being interposed between the bottom surface of the lens and

the recessed portion of the top surface of the base when the lens and the base are coupled together.

56. The button assembly of claim 55 wherein the base
5 diffuses light from a first source passing through the base
when the button assembly is in use.

57. The button assembly of claim 56 wherein the base
further comprises a hollow passage for allowing light from a
10 second source to pass unimpeded through the base when the base
is in use.

58. The button assembly of claim 56 wherein the first
and second light sources are capable of creating light of
15 different colors when viewed through the lens.

59. The button assembly of claim 58 wherein the first
and second light sources comprise two or more lights and
wherein the different light colors are created by varying the
20 intensity of each of the individual lights.

60. The button assembly of claim 59 wherein the first
and second light sources comprise LEDs.

61. The button assembly of claim 60 wherein the first and second light sources each comprise a red, green and blue LED.

5 62. The button assembly of claim 61 wherein the light from the second source passes through a shroud before passing through the hollow passage on the base.

10 63. The button assembly of claim 62 wherein the button assembly is releasably attached to a switch matrix.

15 64. The button assembly of claim 46 wherein the lens further comprises a viewing surface, said viewing surface comprising a first region and a second region, said first region receiving light from a first light source and said second region receiving light from a second light source.

20 65. The button assembly of claim 64 wherein the base further comprises a hollow passage, the light from the first light source traveling primarily through the hollow passage to the first region and the light from the second light source traveling primarily through the base to the second region.

66. The button assembly of claim 65 wherein the first light source is capable of generating light of varying colors when observed by a human in the first region.

5 67. The button assembly of claim 65 wherein the second light source is capable of generating light of varying colors when observed by a human in the second region.

10 68. The button assembly of claim 66 wherein the first light source comprises two or more LEDs controlled by a microprocessor.

15 69. The button assembly of claim 67 wherein the second light source comprises two or more LEDs controlled by a microprocessor.

70. A keypad assembly for interfacing with a control system, said keypad assembly comprising:

a switch matrix, said switch matrix comprising one or more button positions, each button position comprising a first 5 cantilever and a second cantilever;

a circuit board, said circuit board comprising a switch for each button position;

a button or key releasably attached in each button position, each button or key comprising a bottom surface, said 10 bottom surface non-fixidly engaging the first and second cantilevers; and

whereby the switch for each button position may be actuated by depressing its associated button or key, said first and second cantilevers restoring the depressed button or 15 key to its prior position when released.

71. The keypad assembly of claim 70 wherein said first and second cantilevers of each button position exert a force to maintain their associated button or key in an undepressed 20 position.

72. The keypad assembly of claim 70 wherein each button position comprises a first side and a second side, said first

cantilever protruding from the first side and said second cantilever protruding from the second side.

73. The keypad assembly of claim 72 wherein the first 5 and second cantilevers each comprise an attached end and a free end, said free end having a protrusion for non-fixidly engaging the bottom surface of the button or key.

74. The keypad assembly of claim 73 wherein the first 10 cantilever is substantially parallel to the first side and the second cantilever is substantially parallel to the second side.

75. The keypad assembly of claim 70 wherein the switch 15 matrix comprises a frame and two or more cross members, each of the two or more cross members being releasably attached to the frame.

76. The keypad assembly of claim 70 wherein the circuit 20 board further comprises a first light source and a second light source for each button position, said first light source illuminating a first region on the button or key and the second light source illuminating a second region on the button or key.

77. The keypad assembly of claim 76 wherein each button position further comprises a light shroud, said light shroud comprising a top, a bottom, and a hollow light channel, said light shroud disposed over said first light source.

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78. The keypad assembly of claim 77 wherein the button or key comprises a button assembly, said button assembly comprising a lens and a base, said base further comprising an open passage disposed over the top of the shroud thereby 10 allowing light emitted from the first light source to pass through the base unimpeded to illuminate the first region.

79. The keypad assembly of claim 78 wherein light emitted from the second light source travels through the base 15 to illuminate the second region, said base composed of a semi-transparent material to diffuse the light emitted from the second light source.

80. The keypad assembly of claim 79 wherein the second 20 light source is comprised of a first plurality of light sources controlled by a micro-processor, said plurality of light sources capable of producing light of varying colors as dictated by the micro-processor.

81. The keypad assembly of claim 80 wherein the first light source is comprised of a second plurality of light sources controlled by a micro-processor, said plurality of light sources capable of producing light of varying colors as 5 dictated by the micro-processor.

82. The keypad assembly of claim 81 wherein the first and second plurality of light sources each comprise two or more LEDs.

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83. The keypad assembly of claim 82 wherein the two or more LEDs comprises a red, green and blue LED.

84. The keypad assembly of claim 83 wherein the base 15 comprises a top surface having a recessed portion, said lens releasably attaching to the recessed portion, a label being interposed between the lens and the recessed portion of the top surface of the base, wherein the label is illuminated by both the first light source and the second light source.

85. An apparatus for backlighting an object with varying colors of light, said apparatus comprising:

a power supply;

a first plurality of individual light sources each 5 capable of emitting a distinct color of light;

a micro-processor capable of controlling the intensity of each of the first plurality of individual light sources; and

whereby the color of light viewed on the object may be varied by instructing the micro-processor to alter the 10 intensity of each of the first plurality of individual lights.

86. The apparatus of claim 85 wherein the first plurality of individual light sources comprise LEDs.

15 87. The apparatus of claim 86 wherein the LEDs comprise a red LED, a green LED and a blue LED.

88. The apparatus of claim 85 wherein the object is a button or key, said button or key actuating a switch 20 controlling an electrical device.

89. The apparatus of claim 88 wherein the first plurality of individual light sources comprises two or more

LEDs chosen from the group comprising a red LED, a blue LED, and a green LED.

90. The apparatus of claim 89 wherein the color of light
5 viewed on the button or key is dependent upon the status of
the electrical device controlled by the switch.

91. The apparatus of claim 89 wherein the color of light
viewed on the button or key is dependent upon the time of day.

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92. The apparatus of claim 89 wherein the color of light
viewed on the button or key is dependent upon input from a
light sensor.

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93. The apparatus of claim 89 further comprising a
second plurality of individual light sources, said second
plurality of individual light sources also illuminating at
least a portion of the button or key.

94. A switch matrix for use in a keypad, said switch matrix comprising:

a support frame; and

5 at least one key positioning member disposed on said support frame, said at least one key positioning member comprising a first cantilever and key attaching means for removably attaching a key to said key positioning member;

wherein keys of different sizes and shapes may be attached to said switch matrix.

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95. The switch matrix of claim 94 further comprising a switch activating protrusion disposed on said first cantilever.

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96. The switch matrix of claim 95 wherein said switch activating protrusion is disposed on an opposite side of said first cantilever from said key attaching means.

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97. The switch matrix of claim 94 further comprising a second cantilever having a fixed end and a free end.

98. The switch matrix of claim 97 wherein said first cantilever is disposed on said free end of said second cantilever.

99. The switch matrix of claim 98 wherein a free end of said first cantilever extends in a direction toward said fixed end of said second cantilever.

5 100. The switch matrix of claim 97 wherein said first cantilever extends parallel to said second cantilever.

101. The switch matrix of claim 97 wherein said second cantilever comprises a pair of arms, and wherein said first 10 cantilever resides between the pair of arms of the second cantilever.

102. The switch matrix of claim 94 wherein said support frame comprises at least one longitudinal member and at least 15 one lateral member substantially perpendicular to said longitudinal member.

103. The switch matrix of claim 102 wherein said support frame comprises two longitudinal members and four lateral 20 members.

104. The switch matrix of claim 94 wherein said support frame comprises at least one groove for attaching said switch matrix to said keypad.

105. The switch matrix of claim 94 wherein said at least one key positioning member comprises a plurality of key positioning members disposed in a series of rows and columns.

5 106. The switch matrix of claim 105 wherein said series of rows and columns comprises four rows and three columns to include twelve key positioning members.

107. The switch matrix of claim 94 wherein said key attaching member comprises a knob.

108. The switch matrix of claim 107 wherein said knob is substantially diamond shaped.

15 109. The switch matrix of claim 94 further comprising at least one stud disposed thereon for aligning the switch matrix so that the keys register with switches.

110. The switch matrix of claim 94 further comprising at least one leg for supporting said switch matrix in said keypad.

111. The switch matrix of claim 94 further comprising at least one resilient clip for attaching said switch matrix to other components within said keypad.

112. A switch matrix for use in a keypad, said switch matrix comprising:

a plurality of key positioning members, each key positioning member comprising a first cantilever having an 5 attached end, and a second cantilever having a fixed end and a free end, said attached end of said first cantilever disposed on said free end of said second cantilever;

wherein said key positioning members are configured to receive a key such that when said key is depressed, said first 10 cantilever is adapted to deflect to activate a switch.

113. The switch matrix of claim 112 further comprising a switch activating protrusion disposed on said first cantilever.

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114. The switch matrix of claim 112 further comprising key attaching means for removably attaching said key to said plurality of key positioning members.

20 115. The switch matrix of claim 112 wherein a free end of said first cantilever extends in a direction toward said fixed end of said second cantilever.

116. The switch matrix of claim 112 wherein said first cantilever extends parallel to said second cantilever.

117. The switch matrix of claim 112 wherein said second 5 cantilever comprises a pair of arms, and said first cantilever resides between said pair of arms of said second cantilever.

118. The switch matrix of claim 112 further comprising a support frame for supporting said plurality of key positioning 10 members.

119. The switch matrix of claim 118 wherein said support frame comprises at least one longitudinal member and at least one lateral member substantially perpendicular to said 15 longitudinal member.

120. The switch matrix of claim 119 wherein said support frame comprises two longitudinal members and four lateral members.

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121. The switch matrix of claim 118 wherein said support frame comprises at least one groove for attaching said switch matrix to said keypad.

122. The switch matrix of claim 112 wherein said plurality of key positioning members are disposed in a series of rows and columns.

5 123. The switch matrix of claim 114 wherein said key attaching means comprises a knob.

124. The switch matrix of claim 123 wherein said knob is substantially diamond shaped.

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125. The switch matrix of claim 112 further comprising at least one stud disposed thereon for aligning the switch matrix so that the keys register with switches.

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126. The switch matrix of claim 112 further comprising at least one leg for supporting said switch matrix in said keypad.

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127. The switch matrix of claim 112 further comprising at least one resilient clip for attaching said switch matrix to other components within said keypad.

128. A switch matrix for use in a keypad, said switch matrix comprising:

a plurality of key positioning members, each of said plurality of key positioning members comprising a knob; and

5 at least one key having an opening defined by a sidewall, said opening configured to receive said knob to removably attach said at least one key to said knob with a friction fit; wherein said at least one key may be attached to any of said plurality of key positioning members such that a 10 configuration of said at least one key on said keypad may be varied.

129. The switch matrix of claim 128 wherein said at least one key further comprises a light pipe to direct light 15 from a lower surface of said at least one key to an upper surface of said at least one key.

130. The switch matrix of claim 129 wherein said light pipe is attached to said key by interfitting parts such 20 that no adhesive or fasteners are required.

131. The switch matrix of claim 128 wherein said plurality of key positioning members each comprise a first cantilever adapted to deflect to contact a switch.

132. The switch matrix of claim 131 wherein said first cantilever comprises an attached end, said attached end of said first cantilever being attached to a free end of a second cantilever.

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133. The switch matrix of claim 132 wherein said second cantilever comprises a pair of arms, and said first cantilever resides between said pair of arms of said second cantilever.

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134. The switch matrix of claim 128 further comprising a support frame for supporting said plurality of key positioning members.

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135. The switch matrix of claim 134 wherein said support frame comprises at least one longitudinal member and at least one lateral member substantially perpendicular to said longitudinal member.

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136. The switch matrix of claim 134 wherein said support frame comprises at least one groove for receiving a tab to attach said switch matrix to said keypad.

137. The switch matrix of claim 128 wherein said plurality of key positioning members are disposed in a series of rows and columns.

5 138. The switch matrix of claim 128 wherein said knob is substantially diamond shaped.

139. A method of attaching one or more keys to a keypad comprising the steps of:

- (a) providing a switch matrix having a plurality locations where said one or more keys may be attached;
- 5 (b) attaching said switch matrix to said keypad;
- (c) providing said one or more keys of a first size and shape;
- (d) selecting one or more of said plurality of locations on said switch matrix to attach said one or more keys; and
- 10 (e) pressing said one or more keys on said one or more of said selected plurality of locations to attach said one or more keys to said keypad.

140. The method of claim 139 further comprising
15 covering said switch matrix with a face plate.

141. The method of claim 139 wherein step (e)
further comprises joining a knob on said one or more of said
selected plurality of locations with an opening on said one or
20 more keys to fasten said one or more keys to said keypad with
a friction fit.

142. The method of claim 139 further comprising removing said one or more keys from said keypad by pulling on said one or more keys.

5 143. The method of claim 142 further comprising providing one or more keys of a second size and shape different from said first size and shape, and pressing said one or more keys of said second size and shape on said one or more of said selected plurality of locations to attach said 10 one or more keys of said second size and shape to said keypad.

144. The method of claim 142 further comprising selecting another one or more of said plurality of locations and pressing said one or more keys on said another one or more 15 of said plurality of locations to attach said one or more keys to said keypad.

145. A method for attaching keys of different sizes and shapes to a keypad, said method comprising:

- (a) providing a switch matrix having a plurality of attaching means for removably attaching said keys;
- 5 (b) providing said keys having corresponding attaching means independent of the size and shape of said keys;
- (c) selecting a configuration of said keys to be attached on said keypad;
- (d) selecting said attaching means corresponding to the 10 configuration of said keys to be attached on said keypad; and
- (e) joining said corresponding attaching means to said selected attaching means to thereby attach said keys to said keypad.

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146. A switch matrix for use in a keypad, said switch matrix comprising:

a grid of key attaching means for removably attaching keys of different sizes to said switch matrix;

5 wherein said keys may be selectively attached to said key attaching means to form different key configurations.